REMARKS/ARGUMENTS

I. Introductory Remarks.

The Applicants hereby thank the Examiner for the observations in the outstanding Office Action mailed July 24, 2006 and the telephone interview on September 20, 2006. Method Claims 1-20 are non-elected and are withdrawn from consideration. Device Claims 21-22 are pending and Claim 22 is herein amended to better encompass the full scope and breadth of the present invention, notwithstanding the Applicants belief that the claim would have been allowable as originally filed. Applicants have added new Claims 23-27. No new matter has been added by these amendments and new claims. Reconsideration of the present application in light of the foregoing amendment and following remarks is respectfully requested.

Applicants attorney received the Interview Summary dated October 11, 2006. Applicants attorney recalls discussing the distinctions between the present invention and Yu, however, not in regards to the dual damascene as noted in the summary. Although Applicants believe the present invention is distinct in that regard from Yu, other more prominent distinctions were discussed. Specifically, there are structural differences between the prior art devices and the device of the present invention.

II. Rejection of Claims 21 and 22 under 35 U.S.C. §112, first paragraph.

A. Failure to comply with the written description rejection

Claims 21 and 22 have been rejected, under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Examiner asserts that there does not appear to be a written description of the claim limitation that the via hole is of "substantially the same diameter throughout the depth of the via hole." The Applicants respectfully traverse this rejection.

The Applicants would first like to point out that the term vertical sidewalls as used in the application and figures, supports the language of "substantially the same diameter throughout the depth of the via hole." The Applicants disclose at paragraph [0026], that the

vertical sidewalls of the via-hole in the present invention are unexpected results, never achieved before. Applicants disclose in paragraph [0026] that they achieve this unique structure by the addition of the first and second fluoride gas into the chamber, in contrast to the prior art that merely utilized SF_6, i.e., the second fluoride gas. This disclosure in the written description supports the claim limitation that the walls of the via hole are vertical, and by virtue of the sidewalls being vertical, the via hole is "substantially the same diameter" throughout its depth.

With regard to Claim 21, Figures 2A- 2C, and paragraph [0036] clearly provide a written description for the claim limitation. The Examiner points to Figure 3, page 7, paragraph [0029], whereby one embodiment of the present invention comprises a via hole having an opening width of 1.66 microns and a bottom width of 1.32 microns. First, the Applicants point out that Figure 3 is one example of the structure of the via hole created by the present invention. However, even within Figure 3, the structure is of "substantially the same diameter throughout the depth of the via hole", based upon the unit of measurement. The approximate difference, given this example is .34 microns. It appears that the Examiner has failed to appreciate just how small this measurement is, and that holding constant or uniform dimensions at the submicron or micron level is extremely difficult. Therefore, given the size, the terminology "substantially" acknowledges that the diameter is not precisely uniform. At this level of measurement, the structure would be of "substantially the same diameter throughout the depth of the via hole."

The Examiner further asserts that the specification, page 8, paragraph [0032], refers to a tapered via hole of the present invention. The Examiner argues that therefore the via hole is clearly tapered. However, the Examiner does not appear to be appreciating that the cited paragraph is referring to Claim 22, which is a distinct structure from Claim 21. Indeed, Applicants intend for Claim 22 to produce a partially tapered sidewall within the via hole. Applicants have herein amended Claim 22 to clarify the depth of the tapered sidewall in relation to the depth of the via-hole having "substantially the same diameter." Claim 22 has been amended to add that the via hole "is of substantially the same diameter throughout at least one-half the depth of the via hole." Support for this amendment can be found at paragraph [0035], which discloses that the length of the tapered portion of the via is within the approximate range of one-third to one-half the depth of the via. Therefore, the Applicants

respectfully request that this ground for rejection on this basis be withdrawn and that Claim 21 and 22 be passed to allowance.

B. Indefiniteness rejection

Claim 22 has been rejected, under 35 U.S.C. §112, first paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. The Applicants respectfully traverse this rejection. The Examiner asserts that the two terms of the via hole - namely, 1) the tapered sidewall and 2) substantially the same diameter throughout the depth of the via hole, are contradicting each other. As discussed in the above paragraph, Applicants have amended the claim to clearly and particularly point out the subject matter by differentiating between the tapered portion of the sidewalls and the substantially vertical portion of the sidewalls. Therefore, the Applicants respectfully request that this ground for rejection on this basis be withdrawn and that Claim 22 be passed to allowance.

III. Rejection of Claim 21 under 35 U.S.C. §103(a).

Claim 21 has been rejected, under 35 U.S.C. §103(a) as being unpatentable over Yu et al (U.S. Patent No. 6,004,883) of record in view of Lin (U.S. Pub. No. 2002/0068441). The Applicants hereby continue and maintain their traversal of this rejection and respectfully request reconsideration of this ground of rejection in light of the following remarks.

Addressing the cited art, Yu merely teaches a method for forming a via whereby the resulting aperture comprises a second trench corresponding with a first trench and at least a portion of a first via. The method taught by Yu is unable to etch the sophisticated via holes of the present invention. The archaic method of layering trenches disclosed in Yu cannot create vertical sidewalls on a submicron and micron level. This is evidenced at col 4 lines 32-37, "[t]here is then formed upon the blanket hard mask layer a patterned photoresist layer, where the patterned photoresist layer leaves exposed a portion of the blanket hard mask layer greater that an areal dimension of the via and at least partially overlapping the areal dimension of the via." Further, in Yu at col 4 lines 48-50, "[t]he aperture comprises:(1) a second trench

corresponding with the first trench; and (2) at least a portion of the first via." The aperture that results is staggered and does not have smooth vertical sidewalls. There is absolutely no consistent verticality of the walls of the via hole, as is further demonstrated in Yu's figures. The process in Yu results in an entirely different device than that claimed in the present invention. The vias of Claim 21 are dimensionally accurate micron and sub-micron via holes of substantially the same diameter throughout the depth of the via hole due to the prescribed method of the present invention. The via hole that is produced has vertical side walls, see paragraph [0036] for support. There is no teaching, showing or suggestion of verticality of the sidewalls of the via hole in Yu which would result in the present invention's via hole having substantially the same diameter throughout its depth. Therefore, the present invention is unobvious in view of Yu.

Lin may disclose a via with an aspect ratio greater than one, however, there is no teaching, showing or suggestion of vertical sidewalls of the via hole which would result in a via hole having substantially the same diameter throughout its depth. Since Yu does not make the present invention obvious for the reasons stated above, adding Lin merely for the aspect ratio would still not accomplish the structure of the claimed device. Therefore, the Applicants respectfully request that this ground for rejection on this basis be withdrawn and that Claim 21 be passed to allowance.

IV. Rejection of Claim 22 under 35 U.S.C. §103(a).

Claim 22 has been rejected, under 35 U.S.C. §103(a) as being unpatentable over Schuck, III et al (U.S. Patent No. 5,868,951) of record in view of Lin (U.S. Pub. No. 2002/0068441). The Applicants hereby continue and maintain their traversal of this rejection and respectfully request reconsideration of this ground of rejection in light of the following remarks. Independent device Claim 22 is herein amended by inserting the following language that the via hole, "is of substantially the same diameter throughout at least one-half the depth of the via hole."

Addressing the cited art, Schuck merely shows in Figure 4A tapering of the entire via. The Examiner has idealized the drawing to conform to what he believes the invention to be in Schuck. However, nowhere within Schuck does it teach the elements of Claim 22. As argued

throughout this response, the tapering of the sidewalls in the present invention is not throughout the depth of the via hole. It only occurs between the top one-third to one-half of the depth of the via hole. This is specifically done in the present invention to provide advantages over the prior art that could only etch a completely tapered via hole. For example with the present inventions tapering of only a portion, it provides for better metal filling. Applicants have created a novel process to add this advantage without sacrificing the dimensionally accurate sub-micron via holes. As can be seen in Figure 4A cited by the Examiner, the vias formed by Schuck are clumsy and risk overlapping vias and damaging adjacent device features.

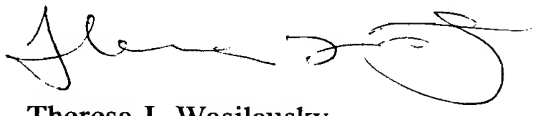
Applicants invention is unobvious, because it presents a novel way to etch vertical sidewalls in a via along with a tapered opening such that via holes are not overlapping and damaging adjacent features. This novel process results in a device that has never before been accomplished on a sub-micron or micron level.

Lin may disclose a via with an aspect ratio greater than one. However, since Schuck does not render the present invention obvious for the reasons stated above, adding Lin merely for the aspect ratio would still not teach or accomplish the structure of the claimed device. Therefore, the Applicants respectfully request that this ground for rejection on this basis be withdrawn and that Claim 22 be passed to allowance.

CONCLUSION

The Applicants would like to thank the Examiner again for the telephone conversation of September 20, 2006. Applicants respectfully request that the device Claims 21, and herein amended Claim 22 be reconsidered in light of the foregoing amendment and remarks, notwithstanding Applicants belief that the claims would have been allowable as originally filed. Further, the Applicants respectfully request that new Claims 23-27 be given favorable consideration. The Examiner is cordially invited to telephone the undersigned for any reason, which would advance the allowance of the pending claims.

Respectfully submitted,



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